THE MODEL ENGINEER

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# Smoke Rings

**South African News**

A RECENT South African mail brought me a copy of *The Outspan*, kindly sent by Mr. C. E. Till, of Johannesburg, an old friend of the " M.E." An illustrated journal sometimes conveys a more complete impression of life in a particular country than it is possible to do in a letter, and I gather from this voluminous and well-produced magazine that while South Africa is very much on the alert and sensible of her responsibilities, social and outdoor life is by no means neglected. My various model engineering correspondents in that Dominion are, as their letters indicate, very busy on war work, but I hope that in due time they will be free to return to their locomotives and power-boats with their minds at peace. Mr. Till also sends me some news about a model engineering demonstration on the Rand. In conjunction with the South African Railways a big display of models and other technical exhibits is to be made by Johannesburg model engineers at what Mr. Till describes as a " Cavalcade " in aid of the Governor General's War Fund. This function is to last from May 23rd to June 1st, and the model display is to be staged in a hall measuring 180 ft. by 50 ft. Models of all kinds, steam, petrol, boats and aeroplanes, will be included, and it is anticipated that although there will be many other popular attractions, the hall of models will be the star feature of the show. Mr. Till, after referring to some of the effects of rationing and other war-time restrictions, adds :—" However, the ' M.E.' arrives. I take it with me on night shift and read it from cover to cover. God bless you all ! "

**Brazing Equipment**

A CORRESPONDENT who says that he is " serving his apprenticeship to model engineering without having had any previous knowledge of engineering," asks for some advice on the construction of blowpipe equipment for brazing. He says :—" I read frequently of ' L.B.S.C.' using his little ' Alda ' oxy-acetylene outfit to braze his boilers, etc. Well, most model engineers are not in a position to own such an outfit. Could some expert give us the works on the next best thing or on how to make the best of brazing by using the domestic coal-gas supply ? How can this best be used in conjunction with high-pressure air supply ? Can the domestic supply of gas be boosted up in pressure by passing through a compressor ? Here is a suggestion for some reader to evolve a twin compressor, one for air and the other for gas. Give us the details of the most powerful blowpipes, bearing in mind that many model engineers get as great an amount of pleasure out of making the outfit, as of using it." Although we have published numerous designs for blowpipes during the past few years there is always room in our pages for some additional hints of the kind desired by my correspondent. At the same time I would remind him, and others, that the new fuel rationing scheme will affect the available gas supply for home workshops as well as domestic uses, and gas blowpipes will possibly have to be put aside for " the duration," or at least used very sparingly. The making of blowpipe equipment may, however, proceed quietly with a view to its profitable use when the gas tap can be turned full on again.

**A Proposed Power-boat Regatta**

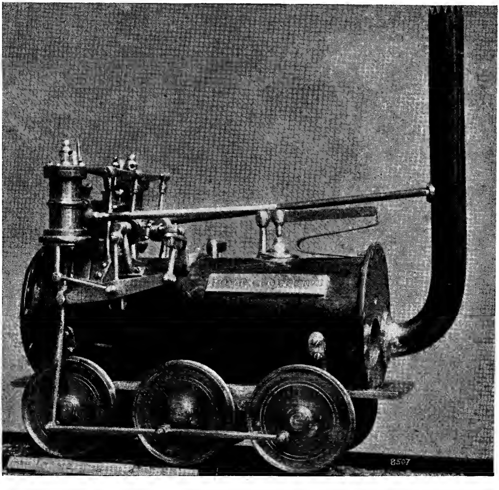
I AM informed by Mr. J. B. Skingley, Hon. Secretary of the Victoria Model Steamboat Club, that a general meeting of members will be held in the boathouse at Victoria Park on Sunday morning next, the 24th instant, to consider the possibility of holding a regatta in the near future. It is hoped that as many members as possible will attend, and I have no doubt that any other London power-boat club enthusiasts would be welcome. It is good to find the Victoria Club turning its thoughts towards another regatta of the kind which have been so popular and enjoyable in peace time. We all need some relaxation of thought and interest, and I know of no better recipe than a friendly gathering of power-boat fans at the lake side.

Percival Marshall

# WHOSE IS IT?

THIS interesting photograph depicts a model that is obviously intended to represent the celebrated *Royal George*, built by Timothy Hackworth for the Stockton and Darlington Railway in 1827. The builder of the model seems, however, to have exercised considerable "model-makers' licence," because, although the general arrangement agrees fairly closely with that of the prototype, and the proportions are reasonably correct, the accuracy of most of the details is decidedly open to question. The chimney is much too high and should be larger in diameter; and it should have a flaired instead of a serrated top. The comparatively clumsy proportions of the motion details are obtrusively noticeable; the plain disc wheels spoil the effect still further, while the safety-valve and its spring must surely be unique!

Unfortunately, we have no particulars of the model, or who built it; neither do we know where it is to be seen, if at all. The photograph, which is a very good one and bears evidence of being "official," was sent us by Mr. Kenneth Crabb, who discovered it in a Birmingham book-shop. Perhaps some reader may recognise the model and be good enough to send us some information about it. That it is of fairly large size is clear from the foot-rule in the bottom left-hand corner.



# A Simple Job for a Beginner

By "L.B.S.C."

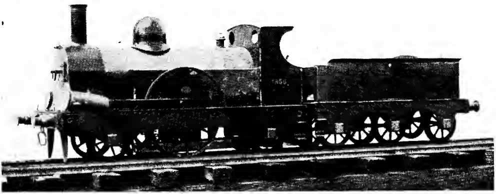


*Photo. by*] [*C. J. Grose*

**A lass of the Old Brigade.**

SOMETIMES when your humble servant gets properly fed-up and very weary, a fairly frequent occurrence now I am getting near to the terminal station of the Great Railroad of Life, I sit down on the tool-box by my bench for a few minutes' rest. Maybe my mind will then go back to the days when my head carried Curly's golden "mop," or to the happy days on the engines of the old "Brighton"; or perhaps some problem or query put by followers of these notes will occupy the brief break. During such a spell about a fortnight or so ago, time of writing, I happened to glance up at the shelf on which stood the old locomotive you see illustrated above, and I thought of my old friend and 'fellow-conspirator" of the railway and the pains he took to turn out a working locomotive with only a few hand tools—all he had in those days.

One thought led to another; and then it suddenly dawned on me that some of my beginner correspondents, who have no lathe and very little equipment, and cannot get any at the present time even if they had the wherewithal, often ask if I could recommend a simple type of engine that could be built without castings, and at the absolute minimum of expense, with just the ordinary tools that can be found in most households. Here was the very thing!

As our worthy friend who operates the camera had arranged to call on the following Saturday, to take some pictures of "Tugboat Annie" with her now finished tender, I got him to take a couple of shots of the old engine at the same time.

**How She is Made**

The wheel and axle arrangement, also the frames, are very much like the Wilson "Jenny Lind" engines of 1847 and onwards. The frames are double, but each pair of wheels has only two bearings, the leading and trailing being in the outside frame, whilst the driving axle is carried by the inside frames. There are no springs nor hornblocks. The leading and trailing axleboxes are filed up from pieces of brass, and fit into slots cut in the outside frames, their falling out being prevented by strips of metal which act as hornstays, and are fixed by screws across the bottom of the slots. Small pieces of brass, each with an arch-shaped slot, are riveted to the inside frames where the driving axle passes through, and these also have metal strips screwed underneath, to keep the driving axle in position. This can be seen in the picture of the "works."

The frames are joined at each end by strips of metal bent over at each end and attached to the frames; the pieces joining the inside frames are parallel with and close to the outside pieces, so that by riveting them together all four frames are held firm and in proper alignment. An old-time wooden buffer beam is attached to the front end. The outside frames are readily detachable by taking out a single screw at each end.

**Wheels**

The driving wheels are 3¼-in. diameter, and of brass. They are very light, and came from one of the old-fashioned "model" shops; in fact, it was I who gave them to my friend all those years ago. The leading, trailing and tender wheels are built up as described just recently; and this should prove a great help to those good folk who have no lathe, or, if they had, cannot get castings to machine on it.

**Cylinder and "Motion"**

The cylinder is a double-action oscillating one, built up from tube and sheet, and mounted on an auxiliary "bed" which fits between the inside frames and is secured by screws. It is ⅜-in. bore and ¾-in. stroke. The barrel is a piece of brass tube. A square flange is soldered to the front end, and a square front cover is attached to this by screws, an extra screw being fitted in the middle of it, for oiling purposes, as there are no other means of lubrication provided. The back cover is not detachable, but is soldered direct to the cylinder barrel. It is furnished with a big studded gland, which is built up. A substantial brass big-end is screwed and soldered to the piston-rod.

The cylinder is pivoted to a steam distribution block in the usual manner by means of a trunnion pin, spring and nut (just like the pump in my little mechanical lubricators) and the distribution block has a disc valve on the back, for reversing purposes; the valve is similar to the recently-described brake valve for "Molly," but it has four ports and two grooves, and is operated from a lever in the cab by means of a long rod passing between the firebox and the inside frame. The distribution block is screwed to the auxiliary frame by the two screws shown in the photo.

On this frame, at the opposite end to the cylinder, there is an intermediate shaft carrying a crank, flywheel and sprocket. This runs in ordinary fixed "plummer-block" bearings screwed to the frame. The crank has a disc web; the sprocket is similar to those in Meccano sets, and is connected by a chain to a sprocket just twice the size, mounted on the driving axle. The cylinder being double-acting, and the ratio of the drive being two-to-one, the engine gives four exhaust beats per turn, same as an ordinary direct-driven two-cylinder job. I must here confess to a hearty chuckle when I first saw the chain drive, thinking of a chain incorporated in the "works" of one type of modern locomotive. The chain on this old iron has lasted the lifetime of the engine without giving a farthing's worth of trouble; I wonder if the same claim will be made for its modern confrère?

As the locomotive was intended to represent an engine of the "Allan" or "Crewe" type of mid-Victorian days, with their characteristic framing and splashers, a pair of dummy outside cylinders and connecting-rods were provided for appearance sake, with the usual box-like cover over the opening cut in the running-board for clearing the connecting-rod.

**Boiler**

When first built, the engine had an ordinary "pot" boiler, with a row of spirit burners underneath it extending almost to its full length; but this was a poor steamer, expensive on fuel, and a prolific waster of heat, so it was replaced by the water-tube boiler which is at present on the engine. The outer casing of this is made from a piece of brass tube 2¼-in. diameter and 8½-in. long, and is practically to "scale" for the type of engine, the originals having boiler barrels which fitted between the backs of the driving-wheel flanges. The tube is split and opened out to form the firebox; and here the builder made his fatal error, which I will explain in a minute or two. The smokebox portion of the casing is made by wrapping a piece of steel sheet, 1½ in. wide, around the barrel and prolonging it down to the inside frames; this forms the front end support, usual in engines of the period. On the full-sized Allan-type engines the smokebox wrapper came right over the outside cylinders; but on this one, separate lagging sheets are used over the dummies, though the smokebox front, complete with dummy door and hinges, is of the correct shape, and carries the "ersatz" front cylinder covers as well. This can be seen in the photo.

The chimney is very reminiscent of the old Brighton engines—the builder "served his time" at Brighton works—and is built up of tube, with a separate polished top. The dome shown in the picture does not belong to the engine; it was just put on temporarily to hide the little thin tube-like gadget which does duty as a dome on the inside barrel. The safety valve is of the type used on the boiler in Noah's Ark; its origin is lost in the mists of antiquity, but it still performs its allotted task!

The inside barrel is made from a piece of thin copper tube, 1½ in. diameter and 7¼ in. long. My old friend had no blowlamp or any other convenience for brazing when he made this boiler, so had to rely on "soft tommy" for keeping the steam and water where they belonged. As soft solder loses its strength under heat, precautions were taken to make the boiler strong enough in construction to withstand the steam pressure, the solder being used only as a caulking;

and to this end the two end-plates of the boiler were let into the barrel and the ends of the latter flanged over them. In addition, a central stay, screwed and nutted at both ends, was provided, and the whole issue well sweated up. There are two 3/16-in. water tubes soldered into the bottom of the barrel, the front end of which is suspended from a triangular-shaped piece of brass riveted to the crown of the outer casing; the extended end of the central stay passes through a hole drilled in the hanging support. The back end of the casing is closed by a dummy backhead, made of steel and partly flanged; the other end of the central stay passes through a hole drilled in the middle, and so affords support to the back end of the barrel.

The thin "tube" dome already referred to is attached to a flange on the barrel by studs and nuts. The steam pipe starts up inside it, and proceeds to the back of the boiler, where it emerges via a flange joint, and then goes down to the firebox, returning to the front end under the barrel, forming a superheater. There is no regulator; in fact, the backhead is absolutely innocent of any semblance of a fitting. Speed control is managed by manipulating the reverse lever.

Reverting to my worthy friend's error with the firebox: like some of the "old school" to this day, he thought it was essential to get the biggest possible "grate area" into his boiler, and so he opened out the boiler casing right up to his auxiliary "engine bed" as you can see from the photo. showing "pit view." This gave a firebox $1\frac{1}{2}$ in. wide and nearly 5 in. long, and in it he arranged a six-wick single-file spirit lamp.

Now although the exhaust from the single cylinder was equal to that of an ordinary two-cylinder engine, and the blastpipe and chimney were quite all right for producing a draught, the maximum draught they could manage was totally inadequate for ventilating such a lengthy firebox crowded with wicks, of the size and number provided. Consequently, only about two of the row, at the leading end, gave out anything like adequate heat, and the rest merely "fumed off" unburnt spirit vapour; so that whilst the *nominal* heating surface was more than required for producing all the steam needed for speed and power, the *effective* heating surface was decidedly not. The engine would run quite well for a little time, but she had nothing like the "kick" and energy which she should have had.

**Tender**

This was a simple affair, merely made for ornament, like those in Mr. Alexander's book. It carried neither fuel nor water, and consisted merely of a soldered-up body, with a pair of frames made like the outside frames of the engine, with similar unsprung axleboxes and built-up wheels. Taking her "by and large," although she wasn't exactly a "star performer" (in which she only emulated many of her big "period" sisters) she was very representative of her time, and very well proportioned. There are certain sentimental reasons why my old friend wants to keep the engine, one being that it bears an honoured mother's name, and she, alas! has passed to the Great Beyond, like Curly's mother; so when he asked if I would care to have a go at the old engine "so that she will be able to haul the Director's saloon," to quote his own words, I told him to send her right along, and I would try to do it as time and opportunity offered. I love the old-timers, and the type of engine appeals to me immensely. Not only that, but I'll just

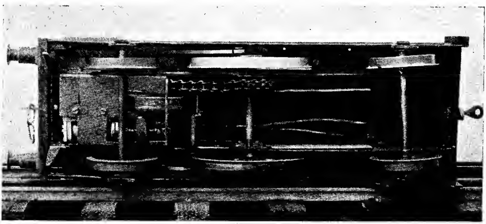


*Photo. by*] **Simplicity in excelsis.** [*C. J. Grose*

be "tickled pink" to make that tiny boiler steam continuously; and after examining the engine and settling a "plan of campaign" I told him it would not only pull the Director's saloon, but one of the Director's kiddies, if not one of those worthies himself!

**As She Will Be**

I propose, first of all, to scrap the oscillating cylinder and all its connections, including the chain drive, and also the dummy outside pair. In place of the latter, a pair of slide-valve cylinders with loose eccentric valve gear will be installed. I have a pair of cylinders taken off a professionally-made job many years ago which were too small for the engine to which they were originally fitted, but should be just right for this one. When I have rebored them they will be about ½-in. bore and ¾-in. stroke, with ports and passages altered to suit; and, with long-travel valves and my pet timing, should only need a breath of steam to keep going with a decent load. The driving wheels will, of course, have axle-boxes and springs, to ensure proper "bite" on the rail heads.

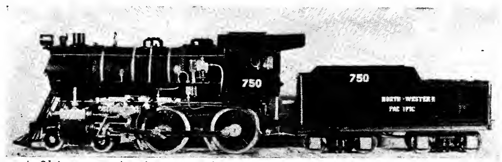
The inside of the boiler will follow the "works" to the junk pile, and will be replaced by a new barrel of similar size, but Sifbronzed to a copper backhead made to fit the existing outer shell. It will have three 5/32-in. Averill-type water tubes, a loop superheater, regulator, blower and all the rest of the blobs and gadgets.

The firebox length will be halved, and a new spirit burner made, either with four 5/16-in. wick tubes arranged in the form of a square, or six ¼-in. in two rows of three, whichever makes the most steam for the least "juice" consumed. Maybe I shall put a proper dome on, with a couple of spring balances; or else a big "vase" casing over a modern direct-acting safety valve. The tender will fulfil its mission in life by carrying a copper water tank, complete with hand pump, and a reservoir for spirit, with a "chicken-feed" apparatus same as I fitted to the something-like-L.M.S. "Princess Eva." With these alterations, she should maintain 80 lb. on the "clock" and go like billyho—and keep going!—with a kiddy on the car; and with about 120 lb. and a pinch of sand under the driving wheels, she should take what's left of poor Curly for a ride.

**Where the Beginner Comes In**

Now to get back to our first paragraph. The engine, as she was originally built, would be a fine example for the novice with very little kit, ditto experience, and a shallow pocket, to copy, provided he makes the following alterations. All the wheels should be sprung; the leading and trailing boxes could have a little spiral spring let into a blind hole drilled in the top, and bearing against the top of the slot, whilst the drivers could have plain boxes sliding in slots in the frame, and single springs underneath, the pins passing through bits of angle brass fixed under the slots by screws.

A cylinder lubricator should be placed under the leading end, and connected to the steam pipe just where it enters the distribution block. The original type of boiler would do, but the firebox casing should only be half the length, say, 2½ in. long at the outside, with the arrangement of burners I propose to put on the rebuild. A cock, or a screw-down valve, should be arranged on the steam pipe to serve as a regulator, at the point where the steam pipe leaves the backhead. The body of the tender should be made of brass, and divided into two compartments, one for water and the other for spirit, a hand pump being provided, feeding into a clack on the backhead. With these alterations, plus reasonable workmanship, the engine should give every satisfaction. I have not suggested any specified dimensions, as there might be some wheels or material that the prospective builder could work in; but the original engine is 11½ in. long, not counting buffers, and the tender is 8¾ in., the rail gauge being 2½ in.




**A 3½-in. gauge American-type 4-4-0 locomotive built by Mr. E. Wright and his son, of Cambridge. The only available drawing was of a 2½-in. gauge engine, which had to be scaled up in the ratio of 5 : 7.**

# *LOCOMOTIVE HEADLAMPS

By F. C. HAMBLETON

No. 8—Lancashire and Yorkshire Railway

IN the years prior to the grouping of the various railway companies, many interesting positions of headlamps on the fronts of locomotives could be observed. Some of the outstanding arrangements have already been described in this series, and to these can now be added the Lancashire and Yorkshire Railway, which employed a unique scheme. Certainly there was no other line whose engines could carry two lights, 1 ft. 6 in. apart, arranged horizontally at the top of the smokebox, and a third lamp over the offside or right-hand buffer! (Fig. 1.) The L. & Y. lamps of the earlier period, that is to say, up till 1886, while Barton Wright was Superintendent, combined a number of features which placed them in a class apart from all other designs. In the first place they were the only square lamps which had an inner casing carrying the coloured shades, which could be inserted in various positions, and which, like the L.B.S.C. Railway lamps, was retained by a spring catch placed on the side. (Fig. 2.)

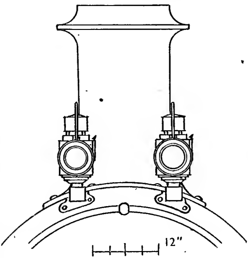



Fig. 1.

The handles were rather short, and the lens was carried in a hood. The lamps were held in lamp-brackets by a foot — and a curious foot at that, since it was oval in plan, and not of the usual square shape. The brackets were, of course, correspondingly shaped; Fig. 1 showing those used for the top of the smokebox, Fig. 3 was the type placed over the right-hand buffer, and Figs. 4 and 5 were those put respectively at the top and on the footplate at the rear of the tender.

When John Aspinall succeeded Barton Wright in 1886 all his engines built at Horwich Works were supplied with the type of lamp just described, but two years or so before the advent of the huge 4-4-2 express engine No. 1400 in 1898, he abolished all the old designs, substituting for the brackets the more customary lamp-irons, and introducing a new form of headlamp based on more orthodox lines. (Fig. 6.) Nevertheless, one

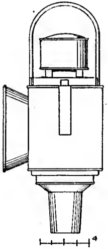



Fig. 2.

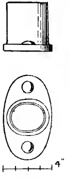



Fig. 3.

* *Continued from page* 450, "*M.E.*," *May* 7, 1942.

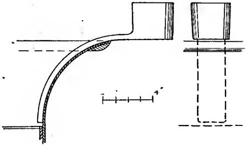



Fig. 4.

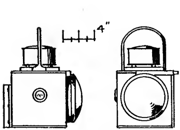



Fig. 6.

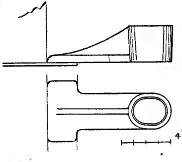



Fig. 5.

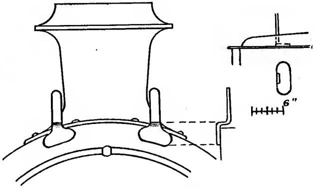



Fig. 7.

or two features made them quite distinctive from those employed by other railway companies. The lenses in the new Aspinall lamps were retained by a polished brass ring, and were set very high in the lamp body. The chief novelty was the little circular window on the side which enabled the firemen to see how things were faring inside ! This feature was quite reminiscent of the magic lantern. The door at the side was kept closed by a spring catch placed horizontally over the top of the lens. The two upper lamp-irons were bent backwards to provide a resting place for the lamps, whereas the footplate lamp-iron was of straight form and the lamp rested on the base of the lamp-iron itself. (Fig. 7.)

Thus it will be seen that the Lancashire and Yorkshire Railway provided its quota of headlamp interest, until the grouping of the lines swallowed up these, and many other pleasantries, of the earlier railway world.

*(To be continued)*

# Black Locomotives

It has been decided that, for the duration of the war, most locomotives on British railways shall be painted black ; no lining or other purely pictorial decoration will relieve the sombre livery. While we regret that such a decision should have become necessary, we are satisfied that it is in the interests of economy. We shall be interested, nevertheless, to note, in due time, how many locomotives which, up to the end of February last were being painted in the pre-war style, will eventually escape the operation of the new order. On the other hand, the scarcity of cleaners, which has been only too apparent in recent years, has led to the vast majority of well-painted locomotives acquiring so thick a coating of grime that scarcely a vestige of the original paint is visible..

So let us hope that, after the war, the railways will be able to give greater attention to this matter, and that when a reversion to attractive painting schemes becomes possible, steps will be taken to improve the general standard of cleanliness.

★ Improving the Two-Stroke

# A 30-c.c. Racing Engine Design

By EDGAR T. WESTBURY

ONCE again it is necessary to apologise to readers for leaving them in the lurch for several weeks, and again the only excuse which can be offered is "circumstances beyond my control." But two-stroke enthusiasts have not by any means been neglected, as the breach has been very adequately filled by the series of articles on Mr. Phillips's 30-c.c. twin two-stroke, a most interesting and enterprising example of model petrol engine design. Personally, I have found the methods of construction used in this engine very refreshing in their originality, and although there are one or two details in the design on which I do not see eye to eye with the designer, there is no doubt that on the whole he has done a very fine job of work. I saw some parts of the engine in its early stages of construction, and was very much impressed by the excellence of workmanship displayed in them; and a few weeks before the articles describing the finished engine appeared in THE MODEL ENGINEER, I had the pleasure of seeing it run at a meeting of the Kent Model Engineering Society. Incidentally, this meeting was still further memorable, in producing yet another example of a twin two-stroke, namely, Mr. Curwen's 6-c.c. engine, which was illustrated in the issue of THE MODEL ENGINEER dated January 15th last.

In my previous article in this series, I gave an outline of the features of design which I consider essential or desirable in a two-stroke engine for model speed-boat propulsion, as a preliminary to describing a design for such an engine, which I have developed in the course of several years' experimental work, but have not yet had an opportunity of testing out in its final form. Many readers have been very anxiously awaiting the appearance of this design, and I am glad to be able, at last, to reward their patience by the publication of the general arrangement drawings of "Atom V," shown herewith in Fig. 107.

Some readers may consider that 30-c.c. engines are too large for most modern constructors, but although the smaller sizes have many attractions, there are still many readers actively interested in the 30-c.c. engine for use in "A" and "B" class racing boats, and the size is an excellent one to practise engine tuning on, as it is large enough to permit of observing effects and making fine adjustments much better than on the smaller engines. It is, as I have pointed out, necessary to acquire quite a fair amount of skill to tune any two-stroke engine, and the smaller the engine the greater the difficulty. If, however, the constructor is determined to build a smaller engine, the design is capable of being scaled down to 15 c.c. or even smaller.

### General Features

Readers who are familiar with the design of "Atom III," which was published in THE MODEL ENGINEER nearly ten years ago, will observe the general similarity in the mechanical design of this engine, indicating its more or less direct descent from the earlier model in the line of development. I have always been fairly convinced that the mechanical design of "Atom III" was quite sound, as it never gave the least mechanical trouble, and stood up to many tests—not to say ordeals—which might well have been considered beyond the limit of endurance of any small engine. From the structural point of view, it may be said that the crankshaft is the central and predominant feature, and that the rest of the essential structure is "built around it."

### Crankshaft

As in "Atom III," the utmost care has been taken to ensure that the crankshaft is not only quite rigid in itself, but also housed in such a way as to be practically immune from deflection. But whereas in the former engine, the crankshaft was built up from two pieces—one comprising the web, balance weight and crankpin, and the other the main journal—it has been considered better in the present case to make it in one piece. One reason for this modification was that some constructors of "Atom III" encountered engine breakdowns, due to imperfect fitting of the taper and driving key at the inner end of the shaft. I do not admit that this can be put down as a fault in the design, as it can be proved that the crankshaft structure is quite satisfactory if really good workmanship is employed. The solid shaft is, however,

* *Continued from page 154, "M.E.," February 12, 1942.*

lighter for a given strength, and takes up less room, than one of the built up type. In proportions and detail design, the shaft exemplifies the features which have been dealt with at some length earlier in these articles.

### Crankcase

In many engines having overhung cranks, little modification is made from the orthodox crankcase design, except to extend the length of the main bearing housing on the appropriate side. The bearers by which the engine is secured to its mounting are often, in such cases, cast or otherwise attached to the sides of the crankcase barrel; but experience suggests the need for extending them towards the outer end of the bearing housing, to steady the latter against side stresses which arise under running conditions. In many cases inadequate support of this end of the engine leads, sooner or later, to more or less serious mechanical trouble. The provision of a wide bearer, such as employed on "Atom III," is a sound remedy for this state of affairs, but introduces some problems in the design of the casting, and is liable to look rather unsightly, and to increase weight more than is desirable.

In "Atom V," I have introduced a very unusual method of supporting the engine on its foundation, by using, in addition to bearer lugs cast on the side of the crankcase, a supplementary cross member made entirely separate to the crankcase casting, and clamped thereto as close to the nose of the bearing housing as possible. This not only provides adequate support for the bearing, but also provides a means of compensating for any possible mis-alignment of the engine mounting, which would otherwise tend to distort the crankcase. In other respects, the crankcase is very similar to that of "Atom III," but is substantially lighter in weight, despite the fact that there is no sacrifice in the stiffness of its essential structure.

### Cylinder

Many constructors of model petrol engines have found it extremely difficult to obtain really sound cylinder castings in a suitable grade of iron to machine nicely and provide good wearing qualities. The model engineering supply trade have not been immune from troubles in this respect, and I know of at least one case where at one time the percentage of "returned duds" in cylinder castings assumed serious proportions. One way out of the difficulty, of course, is the use of a light alloy casting with an inserted liner. This is generally satisfactory up to a point, but many questions have been raised—and never satisfactorily answered—regarding heat conduction losses and different coefficients of expansion; as a result of which, many seekers after high efficiency have regarded this feature with distrust.

The other alternative, which is the more popular among the racing fraternity, is to machine the cylinder from the solid, the material employed being die-cast or centrifugally-cast iron, the machining and wearing properties of which are beyond suspicion. To many constructors, the amount of metal to be removed in machining an air-cooled cylinder in this way may be a serious objection, though it is not so formidable as it seems if tackled resolutely and by proper methods. In the present case, however, the cylinder design is equally suitable for production as a more or less exactly detailed casting, or for machining from a solid billet.

Regarding the rather unorthodox design of the cylinder, combustion-head, and piston, with their port arrangements, the engine may be considered as a compromise between the deflector-piston and the flat-top piston types. It is quite clear that it could not be described as a deflectorless engine, yet the "directed" transfer ports are an essential feature of the functional design, and their correct shape and size are important elements in producing high efficiency. Even more so, in my opinion, is the particular design of combustion-head employed, which is entirely symmetrical, and has the minimum area of surface exposed to flame, so that combustion is extremely rapid and heat loss very small. A high degree of turbulence is produced by the "trapping" effect of the bevelled outer annulus of the piston and cylinder-head, and although it might be considered that the depression in the piston crown would have an adverse effect on scavenging, this does not appear to be so in practice. In experiments with this type of head and port arrangement, remarkably good combustion at all loads and speeds, with fair latitude of mixture strength, has been obtained, indicating that scavenging is substantially above the average standard.

The exhaust ports are situated on opposite sides, in pairs, and slope downwards at the same angle as the sides of the piston crown. Transfer ports, also in opposed pairs, are located at right-angles to the exhaust, and enter at the same angle. The transfer passages are formed by covers, similar to the single cover used on "Atom III," attached by two screws each to flat seatings on the front and rear sides of the cylinder, which enclose the upper and lower sets of transfer ports. If desired, the relative positions of exhaust and transfer ports may be changed over without affecting the performance of the engine, i.e. the transfer ports may be placed at the sides and the exhaust ports at front and rear.

It will be seen that the cylinder is located

symmetrical to the crankshaft centre line, notwithstanding my recommendation of the désaxé arrangement as described earlier in this series. This is mainly because of the expressed desire of readers for an engine adaptable to run in either direction of rotation. The value of the désaxé arrangement is most pronounced at low or moderate r.p.m., and as this engine is intended to do its best 'way up in or near the "ten-thousands," the advantages to be expected from adopting it are not considerable.

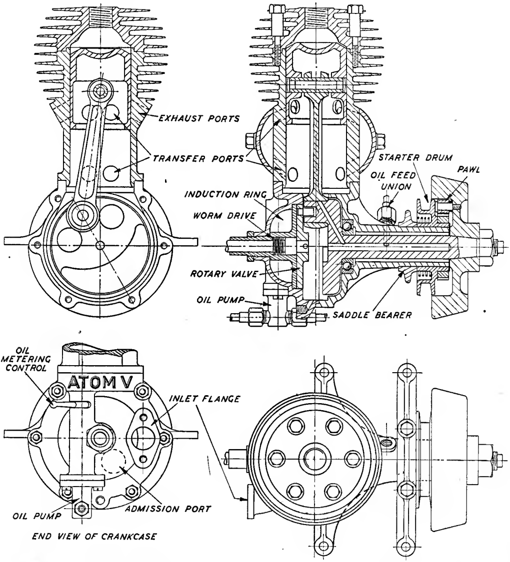



**Fig. 107. General arrangement of 30-c.c. ($1\frac{1}{4}$-in. bore by 1 7/16 stroke) two-stroke engine, suitable for the propulsion of model speed boats.**

**Cylinder-head**

This, like the cylinder, is designed so that it can readily be machined all over from the solid, thus simplifying construction and also reducing the tendency to distortion. It is intended to be made from light alloy, to assist in conveying away heat and also reduce engine weight. The finning of the head is simple, but provides as much effective cooling surface as can be obtained by more elaborate methods. Six 4 B.A. set-screws are employed to secure the head to the cylinder.

**Rotary Admission Valve**

The admission of the mixture to the crankcase is controlled by a flat disc rotary valve, as in "Atom III," but its arrangement has been somewhat modified. Instead of using the end wall of the crankcase as the valve seating, a separate bronze seating, formed by the large diameter flange of the rotary valve shaft bearing bush, is employed. Behind the valve seating is an annular chamber, which forms an "induction ring," as referred to earlier in this series of articles. The entry to this passage is by a port, equipped with a flange for attaching the carburettor, on the outer face of the crankcase.

It has already been noted that readers have expressed a preference to a type of engine which can be adopted to run in either direction, and the design of the induction system has been arranged to conform with this requirement. Many criticisms of the design of "Atom III" were encountered in respect of the fact that it could only be built to run in one direction (unless the castings were altered); and many prospective constructors pointed out, quite rightly, that an engine which could only be built to run one way restricted scope in the mode of installing it in a hull, especially where unorthodox methods, such as tractor propellers or geared drives, were contemplated. For these reasons, I have designed "Atom V" so that it may be adapted to run in either direction simply by altering the position of the port in the rotary valve itself, or of that in the seating flange. The only disadvantage or limitation which this imposes on the design of the induction system is that it does not allow the passage into the induction ring to be disposed tangentially to the latter in the direction of rotation.

In pursuance of the principle of providing a "nucleus" design, in which something is left to the initiative of the individual constructor, the port timing of the engine is designed for *moderately* high performance; this course will be found more satisfactory, particularly from the point of view of less experienced constructors, than attempting to dictate "super-tune" timing, with which most advanced readers would not agree!

**Lubrication**

Provision has been made in the design for incorporating an engine-driven oil pump, full particulars of which have already been given in the issue of THE MODEL ENGINEER dated October 2nd last. This type of pump draws fresh oil from a tank situated in any convenient position, and forces it, in accurately metered volume, to the main bearing; from whence it is conveyed, by drilled passages in the crankshaft, to the crankpin bearing. (By the way, it may be mentioned that there is a slight omission in the longitudinal section, Fig. 107; the extreme end of the axial hole in the main journal should obviously be plugged to prevent escape of oil directly into the crankcase.) While the fitting of this pump is strongly recommended, as it has been proved beyond dispute to be thoroughly reliable, and to be an important factor in the reliability and efficiency of the engine, it is, like many other details in the design, an optional fitting. Some constructors may fancy other types of pumps, either fitted into the engine in a similar way, or otherwise; or perhaps reliance may be placed on the good old-fashioned "syringe" pump, arranged to feed a controlled quantity of oil to the connection on the main bearing. On no account should a type of pump which does not allow of close control of the volume of oil be used on a two-stroke engine, as excess of oil cannot reliably be collected and re-circulated, as is done in a four-stroke engine.

It is, of course, quite practicable to use "petroil" lubrication on this engine, but it is not recommended for the highest performance, as a fairly heavy concentration of oil would be called for, and it is bound to narrow down the carburation adjustment range to some extent, and also liable to increase the difficulty of selecting a suitable sparking-plug.

Experience with "Atom III" has suggested that the provision of direct oil feed to the cylinder wall is unnecessary, but it may be added if desired; the most suitable place to inject the oil appears to be immediately below the exhaust port, where it acts both as a coolant and a lubricant. In this case, therefore, two oil ports, with control valves, would have to be provided on the cylinder skirt. *(To be continued)*

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## For the Bookshelf

**Aero Engine Theory; Aero Engine Practice; Aerobatics.**—London: Sir Isaac Pitman & Sons Ltd. Price 6d. each, postage 2d.

These three handbooks constitute a selection from Pitman's "Simply Explained" series, and are intended as an introduction to the respective subjects, for the elementary instruction of Service personnel and students in aircraft engineering. The first-mentioned book explains briefly and clearly what an aero engine is, and how it works; the second gives a practical insight into the design and construction of the modern aero engine, its testing, maintenance, overhaul and repair; while the third describes the control of aircraft in the various complex manoeuvres which have so far-reaching an effect in modern aerial warfare.

# The "M.E." Beam Engine

## Renders War-time Service

By W. E. PHILLIPS (Sarnia, Canada)

SEVERAL years ago, before the war, the school board of Sarnia opened the shops of the local technical school to adults for evening classes, both men and women. For the men they made available woodworking, machine shop, auto mechanics, drafting and similar subjects. For some three years, I took woodworking, building some furniture. The next year I took machine shop and built a lathe and a bandsaw ; I also did some work on a model gun, finishing it at home.

My ambitions increased and I got a set of castings from England for a beam engine, which was illustrated in colour many years ago, getting the bound back numbers to have complete drawings.

Having got nicely started, planing the bed, the pillar and other parts, and milling the connecting-rod out of a solid piece of steel, the school board decided that as times were hard they would have to close the technical night school at Christmas. While I was taking instruction only as a hobby, there were several men in the class who were following it up in their work. However, as I say, times were tough and no one could see that the world would soon need all the skilled machine hands it could get.

The model progressed very slowly at home, as I did not have adequate time, and the old urge, generated by contact with other men at the school, was lacking. I put all the pieces away in a box and went on with other hobbies.

With the war the school board suddenly realised that the facilities of the school should be used to train mechanics in a hurry, so the different departments went on a 24-hour-a-day schedule. I happened to meet the instructor of one of these emergency classes one evening and he was telling me what they were doing. The old idea of

The " M.E." beam engine built in Canada as a war-time training exercise.

small exercise pieces was out. They were taking on jobs for local war industries that could be done by beginners, and the stress was all on the practical end.

I mentioned I had the old beam engine parts and drawings stowed away and the instructor was definitely interested, as he had no project on hand like it; all the class could do a part and then, when assembled, the test would be—will it run?

I took the whole "works" over to him and he soon gave the boys some practical work, making shop drawings and putting the job into production, as would be done in a commercial shop. Some of the parts were small and had to be to close limits, and he made them all do their part that way. Two of the men were put on erecting and seeing that everything worked out. The principal of the school and visitors were much interested and did a lot of chaffing as to the possibilities of it running.

At last it was all complete, I supplying any parts such as studs and bolts and the base, not to mention dropping in every night or so to give my opinion of how to do it (for whatever that may have been worth). The air line was connected up, 20 lb. pressure, and to the pleasure of the whole class away it went. A little adjusting of the valve-setting and she ticked over beautifully.

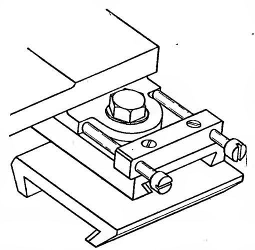
All of the class had done some part, and when the exhibition was held of the work accomplished by that emergency class, the beam engine was the centre of the display. It served as a most useful project, involving every operation in the shop and every man had a hand in it.

Apparently, if you keep a thing seven years, it really has a use. Thus, again, a model has contributed to war effort.

# A FINE ADJUSTMENT FOR TAPER TURNING

THE swivelling top-slide of my "Adept" lathe is secured to the cross-slide by means of a single bolt, which acts as both pivot and clamp—a common arrangement on the lighter types of lathe. This is not a very good construction for accurate work, because it is difficult to set the slide accurately to the angle required, and even when it is set, the action of tightening the bolt shifts it. Moreover, the jarring action of an uneven cut, or a dig-in, may shift the slide while the work is being turned.

The attachment described below allows of setting the top-slide very accurately, and of locking it rigidly in place when set. The slide can be set to turn parallel, or to turn tapers up to some 20 deg. included angle in either direction. Actually, the attachment was made for the purpose of turning a batch of taper shanked centres for the lathe, together with taper reamers to correspond.



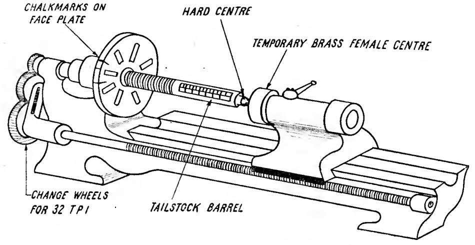
The sketch shows a view of the slide-rest from the rear. A piece of 5/16-in. square material is fastened across the rear end of the cross-slide. Through each end of this piece is tapped a 4 B.A. hole, in which runs a long screw; the points of the screws bear on the foot of the top slide, one on either side of the clamp-bolt.

To adjust the slide, the clamp-bolt is slightly slackened; one adjusting screw is unscrewed, the other screwed in, pushing the slide round; when the correct angle is reached, both adjusting screws are tightened, locking the slide, and incidentally each other. The clamp-bolt can then be tightened without any danger of shifting the slide, nor will any amount of jolting have any effect on the setting.

The range of angles to which this attachment will set the slide is, of course, small; but most of the work on which serious accuracy is needed comes within that range—parallel turning, easy tapers such as are used for lathe centres, and more acute tapers for such purposes as fitting flywheels to crankshafts. The fine threads of the screws give a "micrometer" adjustment, making accurate setting easy, and, once set, the slide can be relied on to stay put.—F. P. NEWLEY.

# Graduating the Lathe Tailstock Barrel

By W. SHEARMAN



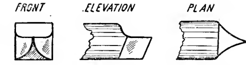

**Set-up for graduating tailstock barrel. (Slide-rest and carrier not shown.)**

A GRADUATED tailstock barrel will be found a great asset when drilling to given depths which have to be carried out from the back poppet. To graduate the barrel of a screw-cutting lathe is a very simple operation, as will be seen from the following account of how the writer did it on his 3½-in. Drummond.

First, a brass plug was turned up to a push fit in front end of tailstock body, a flange being left on to prevent plug slipping too far inside the hole. The plug was then centred and the tailstock barrel set up between centres, the hard centre being in the socket of tailstock barrel and run in the brass plug in body.

The change-wheels were then set up to cut 32 threads per inch, and a tool, shaped as sketch, mounted on the slide-rest. Three lines were then scribed along the barrel to form the stop and start for the long and short lines of the rule about to be formed. At about 3/32 in. from the end a ring was scribed right round the barrel, using the tool already set up, the cross-slide "mike" reading being noted. The tool was then withdrawn from cut and the screw-cutting gear engaged. When all backlash had been taken up, the tool was fed in and adjusted by top-slide to come exactly opposite the ring scribed near the end. When the point of the tool came opposite each of the longitudinal lines a chalk mark was made on the edge of the faceplate and a suitable indexing pointer rigged up.

When all was ready, the lathe belt was pulled round by hand and each time the base line came opposite the tool the same was fed in to the previously noted " mike " reading and either a short or a long division marked off as required ; at the end of each stroke the tool was withdrawn and work revolved another turn and another mark made, and so on to the end. It will be obvious that with change-wheels arranged for 32 t.p.i., each division will be 1/32 in.




**The shape of tool used.**

Numbers to mark the inches may be carefully punched in or etched. The writer used this method successfully to graduate the sleeve of a ½-in. micrometer depth-gauge he made, but, of course, in that case 40 t.p.i. were used.

# A LATHE COUNTERSHAFT

By E. M. HUGHES

**A useful addition to the home workshop, made from the remains of a smashed-up bicycle**

SOME time ago I was given a $3\frac{1}{2}$-in. Pittler lathe which was in very poor shape and minus a lot of parts; but with a little ingenuity and a lot of hard work, my father, a friend and myself managed to get it into running order.

The first task was to find some means of driving the lathe, which up to now we had failed to solve, having no countershaft and being unable to find one suitable for the job. This difficulty was finally solved by bringing into use the frame of my sister's push-bike, which had had an unfortunate argument with a bus and came off second best.

The details and drawings have been submitted in the hope that if any new members of the model engineering fraternity are in like position, this will be of some assistance. I might mention that this shaft has now been in use some eighteen months and has given every satisfaction.

As shown in the sketch, the portion of the frame used was a part of the seat-pillar tube, bottom bracket spindle, bearings and lower back forks. The only other components required for the countershaft were two old chain wheels.

It will be seen that the seat-pillar tube has a flanged plug (*A*) fitted into it to make a foot for securing to the shed wall. This, however, can be dispensed with, the seat-pillar tube being flattened to make a foot. The reason for using the flanged plug was that the seat-pillar tube, being broken off short, could not be flattened and bent.

**Plywood Pulleys**

The flat driving pulley and cone pulleys were made from 6-ply wood. The driving pulley consists of two pieces of plywood glued together and attached to one of the old chain wheels—which had had the pedal-crank removed just clear of the cotter-pin hole—by eight $\frac{1}{4}$-in. bolts. In view of the fact of the spindle not engaging in the pulley, a hardwood false spigot is inserted to ensure concentricity of pulley and spindle.

The cone pulleys are constructed on sandwich lines, i.e. sheet metal being inserted between each layer of 6-ply wood. The construction was as follows:—The second old chain wheel was treated similarly to the first, except that it was reduced in diameter to form the supporting diameter for the biggest of the three pulleys on the cone. In place of the hardwood spigot in the driving pulley, an adaptor (*B* in the sketch) was made and the chain wheel, plywood and sheet metal, mounted and machined on this adaptor for concentricity.

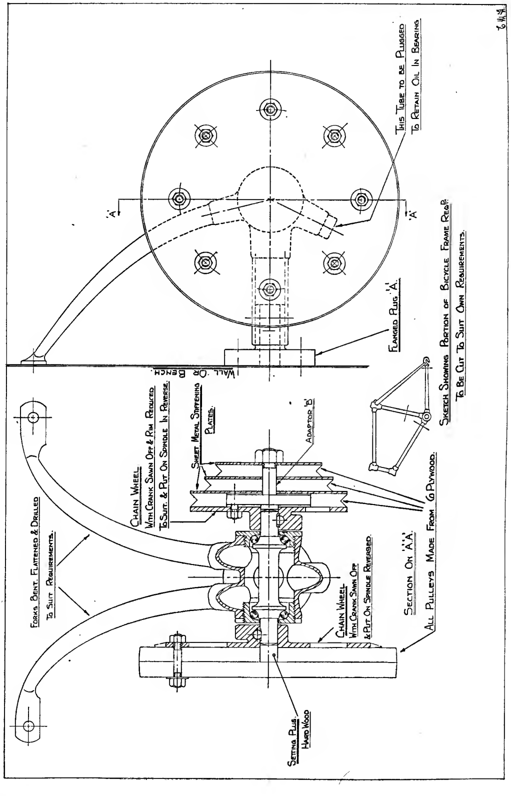
**A Problem**

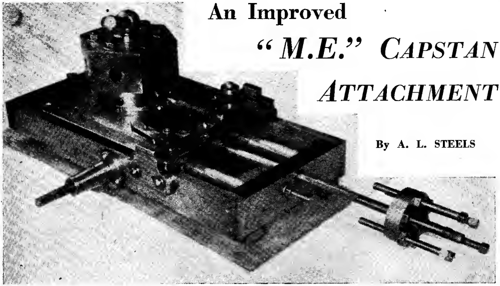
The machining of the pulleys presented a problem in view of my being unable to procure them ready-made. This operation savours of Heath Robinson's best.

However, my countershaft support bracket here came in useful. The rough driving pulley being mounted on the spindle at one end and a pedal-crank on the other, the whole then rigged up in the vice. For a tool-rest I secured a piece of 3 in. × .2 in. timber across the shed, the motive power amounting to 1 man-power swinging on the pedal-crank. It was tough going, but by taking turns with Father we managed to produce a good round and sound job. By this time I had procured a $\frac{1}{4}$-h.p. motor and so the turning of the cone pulleys was somewhat simplified in that, with the bracket now in its permanent position on the shed wall, I could now drive the shaft by the pulley we had just turned.

May I point out that my workshop is a small shed, 6 ft. × 6 ft. 6 in. × 6 ft. high at the front × 5 ft. 6 in. high at the back. As will be seen, I am not blessed with a great deal of room and, therefore, readers will appreciate the advantage obtaining in the design of this countershaft in that it goes into little compass.

At present I am busy making Mr. Edgar Westbury's "1831" engine from home-made castings, etc.; but that is another story, and is taxing my limited powers of improvisation to their utmost in view of the missing parts of the lathe, the most inconvenient being the screw-cutting gear.


This Tube to be Plugged
To Retain Oil In Bearing
'A'
'A'
Flanged Plug 'A'.
Wall Or Bench.
Sketch Showing Portion of Bicycle Frame Reqd.
To Be Cut To Suit Own Requirements.
Chain Wheel
With Crank Sawn Off & Rim Reduced
To Suit. & Put On Spindle In Reverse.
Sheet Metal Stiffening
Plates.
Adaptor 'B'
Forks Bent. Flattened & Drilled
To Suit Requirements.
Chain Wheel
With Crank Sawn Off
& Put On Spindle Reversed.
Section On 'A'A'.
All Pulleys Made From 6 Plywood.
Setting Plug.
Hard Wood



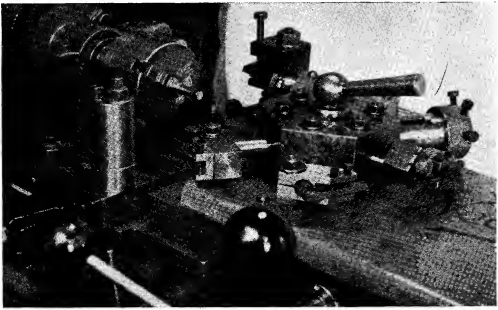
# An Improved "*M.E.*" *Capstan Attachment*

By A. L. STEELS

The capstan attachment detached from lathe, and with slide cover removed.

**Foreword by "Ned"**

Following the publication of a series of articles on the construction of a simple capstan attachment about twelve months ago, many reports have been received from readers expressing appreciation of this modest piece of equipment and telling of its usefulness in the production problems which arise when adapting the home workshop to national service. It is beyond all doubt that even the simplest and lightest lathes are capable of being adapted to reasonably efficient production, and also that there is an increasing interest in this topic; rapid production of small parts has become a major problem in some hundreds of small and meagrely-equipped workshops which are contributing their modest quota to the war effort.



Capstan-head and cross-slide, with tools set up for a run of work.

In the issue of the "M.E." dated October 23rd last, a photograph was published of a capstan attachment built to the above design, but with several interesting and useful additions, by Mr. A. L. Steels, of Cheam, Surrey. Since that date some further improvements have been incorporated in this device, and it has also been in actual service for several months with complete success. Samples of work produced with its assistance have been closely inspected, and have passed limit tests comparable with those applied to the highest class commercial instrument work.

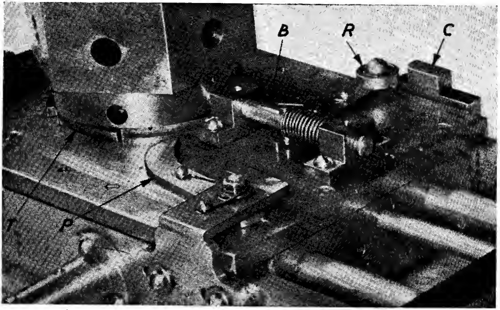
Both in design and execution, Mr. Steels has carried the "M.E." capstan attachment a substantial way beyond its initial conception, but the basic principles remain, and have proved a satisfactory foundation on which to build a thoroughly practical appliance for repetition production of small parts.

* * *

AFTER nearly a year of "going to it" with a four-tool turret and an arrangement of stops reminiscent of Heath Robinson, I felt very keenly the need of a capstan or similar attachment and, with the idea of trying to work out something myself, wrote to our good friend, "Ned," asking him to recommend a book which might help. The necessary recommendation was forthcoming, and also the information that a series of articles on the making of a capstan attachment was to start the very next week in THE MODEL ENGINEER! Could any service be better?

My first reaction on seeing the published design was that the unlocking and shifting mechanism must be automatic, as the previous twelve months had given me something to think about in the matter of undoing, moving round and reclamping a turret. The second point which urged me to elaborate the design was the sight of a windlass handle (with beautiful round knobs) fitted to a high-class capstan lathe!

My lathe is a $3\frac{1}{2}$-in. "Grayson," so the first step was to re-arrange the heights of the various parts, making provision for the automatic bolt and indexing. This automatic indexing takes up the last $1\frac{1}{2}$ in. of travel on the slide, so it was decided that the full stroke should be increased to 5 in., which in turn led to the adoption of $\frac{5}{8}$-in. round slide bars and a stiffer section ($1\frac{1}{2}$ in. $\times$ $\frac{3}{4}$ in.) for the frame and slide cross-bars. The inclusion of the windlass handle and a bolt-releasing cam necessitated side frames, so these were made from $1\frac{1}{2}$ in. $\times$ $\frac{3}{8}$ in. B.M.S. screwed to the frame cross-bars. It was found impracticable to adopt the method described for drilling the holes to receive the slide bars owing to the extra length, so a boring jig was made up on the "button" principle. This consisted of a piece of flat plate with a length of angle-iron riveted to it, a button being placed at the correct distance from the



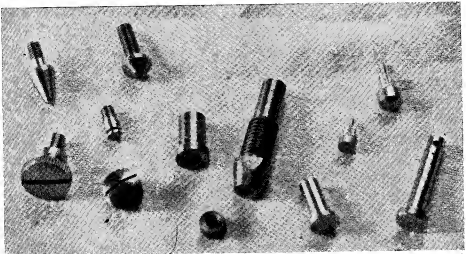

**A close-up of the capstan slide, showing automatic indexing and locking mechanism. B—Locking bolt. C—Stationary cam. P—Indexing pawl. R—Roller. T—Tooth-plate.**

centre. This assembly was then bolted to the faceplate and adjusted for height. The frame cross-bars were then mounted in turn for boring the first hole, which was then slipped over the "button" and the second hole bored. The same procedure was adopted for the slide cross-bars with a piece of packing inserted between the angle and the bar to provide clearance.

The capstan slide-plate was the next part to be tackled, and I think I shall remember this for a very long time—it was my first experience of truing-up a piece of hot-rolled boiler plate with file and scraper. The process is definitely not one of those which is quicker to accomplish than describe.

The turret post and clamp lever need no special mention, as they were made exactly as described. Information on the design and diameter, which gives enough room for ¼-in. B.S.F. stop-screws and lock-nuts. The stop shaft is ⅜ in. diameter. The fixed stop is screwed in a suitable position in the rear frame cross-bar with a clearance hole in the rear slide cross-bar.

The locking bolt ($B$) is made from ⅜-in. round steel and runs in *well fitting* "plummer blocks" along the centre line at the rear of the turret. About the centre of the bolt is fitted a cross pin which engages a lever extending to the rear of the slide-plate. At the outer end of this lever is a tiny ball-race ($R$) which rolls over a "cam" ($C$) fitted to the side-plate. The "cam" is a piece of ⅜-in. flat mild-steel bar, with slotted fixing holes for end adjustment, relieved on the striking face and wide enough to keep the bolt out of engagement until the turret has revolved



**"All in a day's work!"—Samples of small parts, produced by the attachment in actual service.**

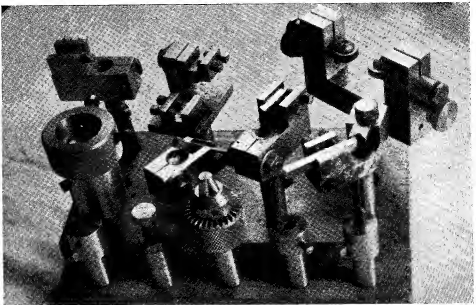
operation of automatic indexing and locking gear was obtained from THE MODEL ENGINEER handbook, "Capstan and Turret Lathes," and reference to the close-up photo. of the turret slide will explain how these additional movements are effected.

The capstan-head was made on the lines of the original except that the size was increased to 4-in. diameter across corners and a separate plate (T) attached by set-screws to provide teeth for the automatic indexing. This tooth-plate was made separately for two reasons, first it was much easier to fashion the teeth in a separate plate, and second it was not hardened and so could easily be replaced.

Advantage was taken of the increased clearance provided by the centre height to increase the diameter of the stop indexing pinion, and the rotating stop holder. The former is 1½-in. p.c.d. and the latter 2 in. half-way to the next tool station. After the bolt lever is released from the cam, a compression spring on the bolt returns it to contact the circular face of the turret, and as the latter completes its part revolution, the bolt slides home in the indexing hole. To cut down the hammering effect and to avoid wear, the bolt clears the turret by 1/16 in. only when out of engagement.

The automatic indexing pawl ($P$) is pivoted on an angle-piece fitted to the side-plate, the angle having slotted holes for adjustment. This adjustment provides that the turret completes its movement at the end of the reverse stroke of the slide.

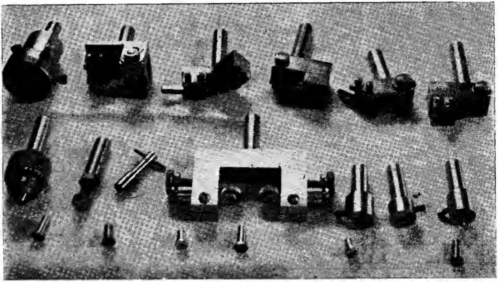
The cover-plate is a necessity, as was found after the first time of using the attachment—the whole works had to be dismantled to clean out brass swarf, which comes off the tool like a miniature fountain and is also carried round by the tool holders.



A group of tools (mostly home-made) used in the capstan attachment.

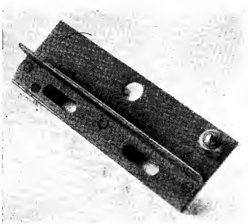
I have not thought it necessary to make drawings for publication, as the photographs reproduced show clearly the details described, and I would recommend that if it is proposed to construct the attachment for any other lathe than the one for which the original design was intended, the layout should be carefully considered with due regard to all the details. One point which deserves mention, and which also applies to the original design, is that the front slide cross-bar could, with advantage, be moved back to a line just in front of the indexing pinion. This enables the turret to project over the cross-slide for working close up to the chuck, and cuts down overhang of the tools.

The windlass handle requires no description, as its characteristics are obvious from the photograph, but in order to prevent disappointment to any would-be enquirer, it



Another view of the capstan tools.

must be mentioned that in order to achieve the " beautiful round knobs," it was necessary to raid my daughter's toy-box for four hardwood balls from a skittle set! The search, in many kinds of shops, for something suitable proved in the end to be quite embarrassing.



**The faceplate jig used for ensuring accurate spacing of the slide-bar holes in cross frames.**

Originally, the gear for working the slide was a copy of the indexing pinion, which engaged in a piece of flat bar fitted to the under-side of the slide-plate, and had holes drilled at even intervals to correspond with the pitch of the pinion teeth. This arrangement worked very well indeed, but on showing the attachment to a professional friend of mine, he was so taken with the job (I hope!) that he went to some trouble in digging out a piece of rack from his " stand-by " box. I procured a suitable pinion to match this rack and, although this works a little smoother, I can say definitely that it is not worth the expense if the parts have to be bought.

Having completed the attachment to a fair degree of accuracy I (not having even *seen* a real capstan lathe) imagined that I could go right ahead and produce repetition work to the " *nth* of a thou."—but I was disappointed. It has been my experience that a "steady" tool-holder is absolutely essential to produce accuracy and finish, and since this accessory was added, I have turned out some hundreds of parts where the tolerance between " high " and " low " limits was 0.0005 in. This, to me, is something of an achievement, and I feel amply repaid for the effort expended in making the attachment. A great deal of my satisfaction is undoubtedly due to the designer, who makes so many difficult things come out easily, and the nicest thing I can say is to confirm his original statement—IT WORKS!

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# Heat Treatment Definitions

**(Confusing Terms)**

DURING recent years, heat treatments of steel have become more and more complicated, and as a result confusion in regard to the meaning of commonly-used terms has arisen. For instance, in some model engineers' workshops any operation of heating and cooling resulting in a softening of the material is called annealing, whereas in other workshops to " anneal " means not primarily to soften but to heat to above the " critical temperature," and to cool very slowly. Similar confusion as to the meaning and application exists in regard to other terms, and as a result " annealing," "tempering," " normalising," etc., are being used by different mechanics to mean widely different things. Reference to the following definitions of heat treatment will help to avoid some of the errors often made :—

*Annealing*.—Heating above the " critical temperature," followed by a relatively slow rate of cooling.

*Normalising*.—Heating above the " critical temperature," followed by an intermediate rate of cooling. In good practice, the heating is considerably above the " critical temperature."

*Hardening*.—Heating above the " critical temperature," followed by a relatively rapid rate of cooling.

*Tempering*.—Reheating, after hardening, to some temperature below the " critical temperature," followed by any rate of cooling.

*Case-hardening*.—Carburising the surface of a component and subsequently hardening by suitable heat treatment.

*Carburising*.—Adding carbon, with or without other hardening elements, such as nitrogen, to steel or wrought-iron by heating the metal below its melting point in contact with carbonaceous material.

*Cyaniding*.—A specific application of carburising where the component is heated and brought into contact with cyanide salt.—A. J. T. E.

# Letters

### The 17-Hole Division-plate

DEAR SIR,—I have followed with interest the various articles appearing in THE MODEL ENGINEER *re* the problem of the 17-hole division-plate.

Now, if a man came into my workshop and asked me to make him a 17-hole division-plate, naturally, I should set about it in the easiest possible way, and, of course, I should turn to the lathe. Not having a dividing instrument of any kind whatever, I should just employ the wheels required to give the required 17 holes on *any* diameter of plate, and I would *guarantee* a degree of accuracy quite equal to, if not superior to, any of the gadgets and contraptions which have appeared in THE MODEL ENGINEER in past weeks. Incidentally, Mr. F. O. Brownson mentions in his article that "he has devised a perfectly good method of circular divisioning suitable for any gear-cutting job on the lathe without using a division-plate of any kind." And so can any other average model engineer, if he cares to go to the trouble.

And now, to conclude, will any reader tell us of what use a 17-hole division-plate is going to be to the average model engineer?

Yours truly,

"M. W. BRAMLEY."

[Our reply to the final query in this letter is that the competition was based on a "one-man" problem, which does not pretend to cater for the needs of "the average model engineer."—Ed. "M.E."]

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# Clubs

### York and District Society of Model Engineers

Next meeting, Friday, June 5th, 7.30 p.m., at "The Bay Horse Hotel," Monk Bar.

Hon. Sec., H. P. JACKSON, 26, Longfield Terrace, York.

### The City of Bradford Model Engineers' Society

The next meeting of the above Society will be held on Thursday, June 4th, Channing Hall, at 7.30 p.m., Open Meeting. These meetings are greatly in favour with a large number of our members; there are always some "bits and pieces" brought along, views, etc., exchanged, and interest is kept at a high level.

We extend a warm welcome to members of H.M. Forces stationed in Bradford, and who are interested in model engineering, to attend any of our meetings.

Hon. Sec. and Treasurer, G. BOWER, 33, Moore Avenue, Wibsey, Bradford.

### West Midlands Model Engineering Society (Wolverhampton Branch)

The next meeting of the above Society will be held at the "Red Lion Hotel," Snow Hill, on Wednesday, June 3rd, at 7.30 p.m.

At this meeting a date will be fixed to visit the works of Mr. N. Harris, at Bilston. Friends and visitors are cordially invited.

Hon. Sec., F. J. WEDGE, 13, Holly Grove, Penn Fields, Wolverhampton.

### The Norwich and District Society of Model Engineers

The above Society met on Thursday, May 7th for the General Meeting.

The attending members formed a "Brains Trust" to answer questions put by any member.

Three of the questions, for example :—

Why does soluble oil, when added to water, turn white?

What is the difference between a turret lathe and a capstan?

Why does a belt ride to the crown of a pulley?

All questions put provoked discussion.

We believe this to be something new for Society meetings, and can recommend it to any Society who are looking for a really instructive and enjoyable meeting.

The next meeting will be held on Thursday, May 21st, at 7.30 p.m., when a paper by Mr. Geo. Archer, of the Aylesbury Gang, will be read.

Hon. Sec., J. POWELL, 29, Spinney Road, Thorpe, Norwich.

### The Kent Model Engineering Society

The next meeting of the Society will be held on Sunday, May 24th, when Mr. E. Vanner will give a talk and practical demonstration on "Metal Boat-hulls."

For the following meeting, May 31st, each member is asked to bring some piece of work and give a ten minute talk describing its construction.

June 7th, an all day track run, commencing 11 a.m.; the new track extension is well under way, and it is hoped to have an additional eighty feet of track in operation.

Particulars of membership can be obtained from Hon. Sec., W. R. COOK, 103, Engleheart Road, S.E.6.

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## NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

**Readers desiring to see the Editor personally can only do so by making an appointment in advance.**

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Cordwallis Road, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Cordwallis Road, Maidenhead, Berks.